

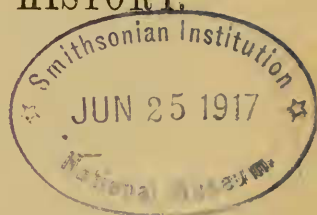
# THE ANNALS

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XL.—*Notes on Collembola.*—Part 4. *The Classification of the Collembola; with a List of Genera known to occur in the British Isles.* By JOHN W. SHOEBOTHAM, N.D.A., Berkhamsted, Herts.

IN my paper on "Some Irish Collembola" (1914), p. 59, I remarked that the classification adopted was one which, in the main, had been accepted by authors for the previous seven years, and that Dr. Börner had recently proposed a new system on which I should make some notes.

This paper was practically completed during the early part of 1914, but my unexpected call to South Africa prevented me publishing it, and I then intended waiting till I returned to England. However, as I am about to publish a preliminary account of the Collembola of Lancashire and Cheshire, I feel it is just as well to list them according to the new system, which is much to be preferred to any yet proposed. I therefore give here a translation of part of Börner's paper (1913 *b*), pp. 318–322, which forms a key to the new classification, and I append a list of the genera of Collembola hitherto found in the British Isles.

My best thanks are due to Dr. A. D. Imms, of the University of Manchester, for kindly seeing this paper through the press and for criticisms and suggestions, and to Mr. T. A. Coward, also of Manchester University, for much kind assistance.

There have been many different arrangements of the Collembola made during the last 75 years, and the number of families recognized has varied from 3 to as many as 8.

Nicolet (1842) has the springtails divided into the *Smynturelles*, *Podurelles*, and *Lipurelles*, and Lubbock (1862) called these *Smynthuridae*, *Poduridae*, and *Lipuridae*, while in his monograph (1873) he formed 6 families, viz., *Smynthuridae*, *Papiriidae*, *Deyeeriadae*, *Poduridae*, *Lipuridae*, and *Anouridae*. Various modifications were used by authors till the end of the 19th century, when another family—*Neelidae*—was made for the reception of the genus *Neelus* of Folsom. Schäffer (1896), in his paper on "The Collembola from the Neighbourhood of Hamburg," differentiated the subfamilies *Isotominae* and *Tomocerinae*, which now rank as separate families.

During the present century the work of Börner has done much to advance our knowledge of the classification of the order Collembola. In one of his earliest papers (1901 *a*) he divided the Collembola into two suborders, the linear kinds to be grouped under the name *Arthropleona* and the globular forms he called *Symphyleona*. Keys were given to the families and subfamilies of the *Arthropleona*, and these, together with an account of the *Symphyleona*, were given in more detail in his paper on "The Apterygotal Fauna of Bremen" (1901 *b*). Then, in 1906, in his work on "The Classification of the Collembola," Börner discussed the whole group and the relationship of the families, subfamilies, and tribes. He recognized the families *Poduridae*, *Entomobryidae*, *Neelidae*, and *Smynthuridae*, and gave a synopsis of the subfamilies and tribes. This system, with but little variation, was used by authors for many years. Then, in 1913, when examining some species of *Pseudosira* and *Paronella* from Java, Börner happened to find a peculiar structure on the hinder trochanters, in the form of a number of short, outstanding, pointed bristles, to which he gave the name "Trochanteral organ." On looking through his collection of slides, he found that this structure was present in all the true *Entomobryinae*, but absent in the *Tomocerinae* and *Isotominae*. This discovery led Börner to propose a new arrangement of families, which I give in this paper. He firstly divided the *Arthropleona* into two natural sections according to the structure of the prothorax (see below, in Key to Families, etc.). The old family *Poduridae*, which corresponds to the new section *Poduromorpha*, was divided into three, the subfamilies *Hypogastrurinae* and *Onychiurinae* being raised to the family rank, and the name *Poduridae*

restricted for the single genus *Podura*. The second section *Entomobryomorpha*, which corresponds to the old *Entomobryidæ*, was also split into three; the name *Entomobryidæ* was retained for those species possessing the Trochanteral organ, and the rest divided into two new families, *Isotomidæ* and *Tomoceridæ*. The *Sminthuridæ* and *Neelidæ* remained as before.

This classification gives us 8 families, and it may seem a large number for so small an order, but there are many districts in the world that have never been searched for springtails, and others in only a haphazard manner, and, doubtless, when the group has been more thoroughly worked, there will be hundreds of new species discovered, which will result in the formation of new genera, and probably of the larger divisions also.

As an example of how a tribe has increased in size and importance in recent years, take the *Cyphoderini*. This tribe for many years contained only the one genus *Cyphoderus*, Nicolet (1842), and that genus, as we know it to-day, contained only two or three species up to the end of the 19th century. Now, as a result of collections made in various parts of the world, there are the additional genera, *Cyphoderodes* of Silvestri (1911), *Pseudocyphoderus*, Imms (1912), the peculiar genus *Calobatella* described by Börner (1913 a). The genus *Cyphoderus* now contains a dozen or more species, with the probability of the number being increased in the near future.

*Synopsis of Suborders, Sections, Families, Subfamilies, and Tribes of the Order Collembola, taken from Börner (1913 b), pp. 318-322.*

- A. Body flattish-cylindrical, elongated, as a rule distinctly segmented, with free thoracic and free abdominal segments; rarely the abdominal segments 5 and 6 or 4-6 are fused together.  
Suborder ARTHROPLEONA, C. B., 1901.
- I. *Tergum of the prothorax similar to the terga of the other body-segments*, always, as in the case of these, *possessing some hairs*. Furcula present or absent, in the first case lying under abdominal tergum 4. Integument generally granular, mostly soft, seldom with stouter chitinized sclerites. Ventral tube always short, pocket-like, smooth-walled. Manubrium ventrally always without hairs.  
Section PODUROMORPHA, C. B., 1913.
- a. *Without pseudocelli*. With or without eyes. Sensory organ of the third antennal segment only with sense-rods, without sense-cones, without outer papillæ. Fourth antennal segment without subapical sense-pit, always with retractile sense-knob.

1. *Head hypognathous*. Eyes situated near the hind edge of the head. Dentes bowed in the horizontal plane, annulated towards the end, over-reaching the ventral tube. Manubrium in form recalling that of the Symphypleona, with a special medial support-piece of the dentes.
  1. Family PODURIDÆ (C. B.), 1906.
2. *Head obliquely prognathous*. With or without eyes, these, if present, situated in front of the middle of the head. Dentes not annulated, fairly straight, seldom reaching past the ventral tube, or the furcula more or less completely reduced. When the furcula is present the manubrium is simple in form, without the medial support-piece of the dentes.
  2. Family HYPOGASTRURIDÆ (C. B.).
    - i. Mandibles with well-developed molar plate.
      - Subfamily HYPOGASTRURINÆ, C. B., 1906.
    - ii. Mandibles without true molar plate or absent.
      - Subfamily ACHORUTINÆ, C. B., 1906.
        - \* Anal segment with undivided supra-anal valve. With or without furcula.
          - Tribe PSEUDACHORUTINI, C. B., 1906.
        - \*\* Anal segment with double-lobed broader supra-anal valve. Without furcula.
          - Tribe ACHORUTINI, C. B., 1906.
  - b. *With pseudocelli*. Without eyes. The sense-organ on antenna III. provided with from 2-3 sense-cones, and often at the same time with outer papillæ and protecting bristles, in addition to the sense-rods. Post-antennal organ generally well-developed. Antennal segment 4 generally with subapical sense-pit (= *Lipuridæ*, Lubbock, 1869<sup>1</sup>.)
    3. Family ONYCHIURIDÆ (Lbk., C. B.).
- II. *Tergum of the prothorax always membranous and without hairs*. Furcula generally present, and in the more recent forms of the group pushed analwards. Integument generally smooth, mostly with sclerites. Ventral tube short or elongated, sometimes with a lateral blind sac. Manubrium ventrally, generally with hairs or scales, seldom naked.
  - Section ENTOMOBRYOMORPHA, C. B., 1913.
    - a. *Trochanteral organ absent*. Ventral edge of the claw simple, without groove.
      1. Third and fourth abdominal terga of nearly equal length or the 4th longer, sometimes this (the 4th) fused with the 5th and 6th (without scales<sup>2</sup>). Naked or ciliated sensory setæ (= *bothriotriche*) present or absent.
        4. Family ISOTOMIDÆ (Schffr., C. B., 1896-1903.)

<sup>1</sup> This should be 1870. Lubbock's "Notes on the Thysanura—Part 4," was published in 1870, not 1869.—J. W. S.

<sup>2</sup> This is as given by Börner (1913 *b*); but, to include the genus *Oncopodura*, Carl & Lebed., it should now read "Scales nearly always absent, when present they are without longitudinal ribs."—J. W. S., 1914.

- i. Head obliquely prognathous. Antennæ inserted in the front half of the head. (Tracheæ absent.) Furcal segment without chitin-ridges, to which are articulated the basal sclerites of the furcula if these (the chitin-ridges) are present. Furcula seldom absent. Post-antennal organ generally present.

Subfamily ISOTOMINÆ, Schffr., 1896.  
(Including the ISOTOMURINI, C. B., 1906.)

- ii. Head hypognathous. Antennæ inserted in the middle of the head. (Head tracheæ present.) Furcal segment with two stout chitin-ridges, which serve for the articulation of the basal sclerite of the furcula.

Subfamily ACTALETINÆ, C. B., 1906.

2. Third abdominal tergum considerably longer than the fourth, all abdominal segments free. With longitudinally ribbed scales. Post-antennal organ absent. Sensory setæ present, ciliated. Furcula always present.

5. Family TOMOCERIDÆ (Schffr., 1896).

- i. Dentes annulated; mucro diminutive, without hairs. Antennal segments 3 and 4 about equally long.

Subfamily LEPIDOPHORELLINÆ (C. B., 1906.)

- ii. Dentes not annulated, 2-segmented; mucro longish, with hairs. Third antennal segment strikingly elongated (this annulated as well as the fourth).

Subfamily TOMOCERINÆ (C. B., 1906).

- b. *Trochanteral organ present* (on the trochanters of the hind legs). Ventral edge of the claws as a rule with basal groove ("split"). Hairs and scales (at least in part) ciliated. Fourth abdominal tergum as a rule considerably longer than the third. Ciliated sensory setæ always present. Furcula always present.

6. Family ENTOMOBRYIDÆ (C. B., 1906).

1. Dentes slender, annulated dorsally here and there. Mucro small. With or without scales. With or without eyes. Empodial appendage with 4 wing-corners.

Subfamily ENTOMOBRYINÆ (C. B., 1906).

- i. Antenna 4-segmented, with undivided basal segments.

Tribe ENTOMOBRYINI, C. B., 1906.

- ii. Antenna 5- or 6-segmented, with the first or first and second segments secondarily divided into two.

Tribe ÔHCHESELLINI, C. B., 1906.

[Here also belongs, presumably, the *Heteromuricinæ* of Imms, 1912. The medial cercus described by Imms should be nothing else than a peculiarly elongated supra-anal valve.]

2. Dentes not annulated, not, or only a little, tapered towards the end.

- i. Dentes without dorsal ciliated scales or ciliated spines, dorsally and dorso-laterally (often completely all round) uniformly haired; if dental spines are present, then sometimes they are modified into bristles at the ends of the dentes. Empodial appendage with 4 strong wing-corners.

Mucrones plump. Coxæ strikingly short. With or without scales. The hitherto known forms with eyes and free-living. Subfamily PARONELLINÆ (C. B., 1906).

- ii. Dentes with dorsal ciliated scales or ciliated spines, these at the bases of the dentes pass over into ciliated bristles. Coxæ generally distinctly longer than the trochanters (also in *Troglopedetes*?). Empodial appendage with 3 wing-corners, or more or less reduced. Eyeless and scaled. Subfamily CYPHODERINÆ (C. B., 1906).

\* With one entodorsal row of ciliated spines on the dentes. Free-living in caves.

Tribe TROGLOPEDETINI, C. B., 1913.

\*\* With a double row of ciliated scales on the dentes. Mandibles with or without molar plate. Head obliquely prognathous, or hypognathous. Claws normal or with a bladder-like terminal portion. Mostly living in association with ants or termites.

Tribe CYPHODERINI, C. B., 1913.

B. *Body pear-shaped to almost globular, as a rule, with obsolete segmentation of the thorax and the first 4 abdominal segments; especially the abdominal terga and pleuræ not differentiated. The ano-genital segments remain mostly independent, but are occasionally fused together. Manubrium with a medial support-piece of the dentes, similar to the Poduridæ, ventrally always without hairs. Pronotum (sometimes also the metanotum) without hairs.*

Suborder SYMPHYPLEONA, C. B., 1901.

a. *Antennæ inserted in or in front of the middle of the head, always considerably shorter than the head-diagonal, 4-segmented; head without elevated vertex. Corpus tenaculi without bristles. Coxæ elongated, also on the outer side distinctly longer than the trochanteral segment. Ano-genital segment concealed under the furcal segment (seen from above). Abdominal sensory setæ absent.* 7. Family NÆELIDÆ, Folsom, 1896.

b. *Antennæ inserted behind (over) the middle of the head, generally considerably longer than the head-diagonal, not rarely with subdivided segments. Head with distinctly elevated vertex over the neck. Corpus tenaculi (generally) with bristles. Coxæ not elongated, on the outer side considerably shorter than the inner side and than the trochanteral segment. Ano-genital segment not concealed under the furcal segment. Abdominal sensory setæ present.* 8. Family SMINTHURIDÆ, Lubbock, 1862.

1. *Ventral sac (tube) even in full-grown animals smooth-walled (seldom at the tips with small warts—after Linnaniemi). Corpus tenaculi with lateral appendage (stylus?) at the base of the rami. Integument granular. Tracheæ (always?) present.* Subfamily SMINTHURIDINÆ, C. B., 1906

\* Anal and genital segment fused, on each side with two (one small) sensory setæ.

Tribe SMINTHURIDINI, C. B., 1913.

\*\* Anal and genital segment separated, sometimes the latter fused with the furcal segment. The genital segment with only one sensory seta.

Tribe KATIANNINI, C. B., 1913.

2. *Ventral sac* (tube) in full-grown animals with *warted walls*. Antennæ always distinctly bent.
- i. *Antennæ bent between the 3rd and 4th segments*, 4th segment longer than the 3rd, the latter always undivided. Furcal segment without paired dorsal papillæ. Corpus tenaculi at the base of the rami without lateral appendage. Tracheæ present (always?). Genital and anal segment not fused.  
Subfamily SMINTHURINÆ, C. B., 1906.
- \* Tibio-tarsus at the distal end on the hind side with 2-3 (seldom with a 4th on the front side) more or less closely applied clubbed hairs, not, or only little, over-reaching the claws. With or without empodial appendage. Mucronal bristle absent. Tribe BOURLETIELLINI, C. B., 1913.  
[Here also belongs the genus *Corynephoris*, Absolon (1907), which is very nearly related to *Bourletiella*, and which only differs by the absence of the empodium and through the dorsal clavate appendage. It is doubtful also whether it possesses tracheæ; abdominal sensory setæ are, however, present in normal numbers.]
- \*\* Tibio-tarsus without the described clubbed hairs, having instead sometimes outstanding, finely knobbed, clavate hairs. Mucro with or without bristle.  
Tribe SMINTHURINI, C. B., 1913.
- ii. *Antennæ bent between the 2nd and 3rd segments*, 4th always shorter than the 3rd. Furcal segment with one pair of dorsal papillæ. Corpus tenaculi as in 1 (i. e. *Sminthuridinae*). Tracheæ absent (always?). Genital and anal segment fused.  
Subfamily DICYRTOMINÆ, C. B., 1906.

### The Genus *SIRA*, Lubbock.

In 1870, in his "Notes on the Thysanura—Part 4," Lubbock described several *Collembola* new to the English Fauna, and one formed the type of a new genus which he called *Sira* (*Seira*). In his monograph, three years later, he described several species under *Sira*, including

- S. domestica* (Nic.).  
*S. nigromaculata*, Lbk.  
*S. buskii* Lbk.

In later years the genus was split up, and Schött proposed the name *Pseudosira* for types like the *S. domestica* (Nic.), leaving the name *Sira* for those like *nigromaculata* and *buskii*. But this should not be so, for Lubbock expressly states that *domestica* forms the type of his genus *Sira*. Therefore *Pseudosira* must fall and *Sira* take its place, and for the species hitherto included in *Sira*, I propose the new name *Willowsia*<sup>1</sup>.

<sup>1</sup> Named after my friend Mr. F. W. Willows, of Tsolo, South Africa.

Genus *SIRA*, Lbk., mihi.

*Seira*, Lubbock (1870), p. 279.  
= *Pseudosira*, Schött.

Dentes ventrally covered with scales.

Type. *S. domestica* (Nic.).

Genus *WILLOWSIA*, gen. nov.

Dentes ventrally only with ciliated hairs, without scales.

Type. *W. (Seira) nigromaculata* (Lbk.).

*List of Genera of Collembola found in the British Isles.*

Class **INSECTA**.

Subclass **Apterygota**, Oudns.

Order **COLLEMBOLA**, Lbk.

Suborder **ARTHROPLEONA**, C. B.

Section **PODUROMORPHA**, C. B.

I. Family **Poduridæ** (C. B.).

1. Genus **PODURA**, Linn., Tbg.

II. Family **Hypogastruridæ** (C. B.).

Subfamily **HYPOGASTRURINÆ**, C. B.

2. Genus **HYPOGASTRURA**, Bourl., C. B.

3. Genus **XENYLLA**, Tbg.

4. Genus **WILLEMIA**, C. B.

5. Genus — ?

A genus comes here related to both *Hypogastrura* and *Xenylla*. I have an English species in my collection, which in many respects is intermediate between these two genera, but so far I have not described it. Possibly it is *Beckerella*, Linnaniemi.

Subfamily **ACHORUTINÆ**, C. B.

Tribe **PSEUDACHORUTINI**, C. B.

6. Genus **PSEUDACHORUTES**, Tbg.

7. Genus **MICRANURIDA**, C. B.

8. Genus **ANURIDA**, Laboulb.

9. Genus **FRIESEA**, D. T.



10. Genus *CHONDRACHORUTES*, Wahlgr.

[The genus *Chondrachorutes* of Wahlgren has not been previously recorded from the British Isles, but it nevertheless occurs there, for I took specimens at Berkhamsted, Herts, in 1910, but have not yet described them.]

Tribe *ACHORUTINI*, C. B.

11. Genus *ACHORUTES*, Templ., C. B.

= *Neanura*, MacG.

III. Family *Onychiuridæ* (Lbk., C. B.).

12. Genus *ONYCHIURUS*, Gerv., C. B.

13. Genus *PROTAPHORURA*, Absln., C. B.

14. Genus *TULLBERGIA*, Lbk.

Section *ENTOMOBRYOMORPHA*, C. B.

IV. Family *Isotomidæ* (Schffr., C. B.).

Subfamily *ISOTOMINÆ*, Schffr.

15. Genus *ISOTOMA*, Bourl., C. B.

16. Genus *AGRENIA*, C. B.

17. Genus *PROISOTOMA*, C. B.

17 *a.* Genus ? *ARCHISOTOMA*, Linnaniemi.

[Linnaniemi has proposed the genus *Archisotoma* for the reception of *Proisotoma besselsi* (= *P. spitzbergenensis*, Lbk.), but as I have neither my specimens of *besselsi* nor Linnaniemi's description by me at the moment, I cannot say whether it should be regarded as a separate genus or as a subgenus of *Proisotoma*.]

18. Genus *ANUROPHORUS*, Nic.

19. Genus *FOLSOMIA*, Willem.

20. Genus *TETRACANTHELLA*, Schtt.

21. Genus *ISOTOMODES*, Axels-Linn.

22. Genus *ISOTOMURUS*, C. B.

23. Genus *ONCOPODURA*, Carl & Lebed.

Subfamily *ACTALETINÆ*, C. B.

[The subfamily *Actaletinæ* is not represented in the British Isles.]

V. Family **Tomoceridæ** (Schffr.).

Subfamily *LEPIDOPHORELLINÆ*, C. B.

[The subfamily *Lepidophorellinæ* is not represented in the British Isles.]

Subfamily *TOMOCERINÆ* (C. B.).

24. Genus *TOMOCERUS*, Nic.

24 a. Genus ? *POGONOGNATHUS*, C. B.

[Börner has proposed the genus *Pogonognathus* for the species *Tomocerus* (*P.*) *longicornis* Müll.]

VI. Family **Entomobryidæ** (C. B.).

Subfamily *ENTOMOBRYINÆ* (C. B.).

Tribe *ENTOMOBRYINI*, C. B.

25. Genus *ENTOMOBRYA*, Rond.

26. Genus *SINELLA*, Brook.

27. Genus *LEPIDOCYRTUS*, Bourl.

28. Genus *SIRA*, Lbk., Sbthm.

29. Genus *WILLOWSIA*, gen. nov.

Tribe *ORCHESELLINI*, C. B.

30. Genus *ORCHESELLA*, Templ.

31. Genus *HETEROMURUS*, Wankel.

Subfamily *PARONELLINÆ*, C. B.

[The subfamily *Paronellinæ* is not found in the British Isles.]

Subfamily *CYPHODERINÆ* (C. B.).

Tribe *TROGLOPEDETINI*, C. B.

[This tribe has not yet been found in the British Isles.]

Tribe *CYPHODERINI*, C. B.

32. Genus *CYPHODERUS*, Nic.

Suborder *SYMPHYPLEONA*, C. B.

VII. Family **Neelidæ**, Flsm.

33. Genus *NÆELUS*, Flsm.

34. Genus *MEGALOTHORAX*, Willem.

VIII. Family *Sminthuridæ*, Lbk.

Subfamily *SMINTHURIDINÆ*, C. B.

Tribe *SMINTHURIDINI*, C. B.

35. Genus *SMINTHURIDES*, C. B.

Tribe *KATIANNINI*, C. B.

36. Genus *SMINTHURINUS*, C. B.

37. Genus *ARRHOPALITES*, C. B.

Subfamily *SMINTHURINÆ*, C. B.

Tribe *BOURLETTIELLINI*, C. B.

38. Genus *BOURLETTIELLA*, Banks, C. B.

Tribe *SMINTHURINI*, C. B.

39. Genus *SMINTHURUS*, Latr., C. B.

40. Genus *ALLACMA*, C. B.

41. Genus *SPHRYOTHECA*, C. B.

Subfamily *DICYRTOMINÆ*, C. B.

42. Genus *DICYRTOMA*, Bourl., C. B.

43. Genus *DICYRTOMINA*, C. B.

44. Genus *PTENOTHRIX*, C. B.

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XLI.—*Notes on Fossorial Hymenoptera*.—XXVIII. *On new Ethiopian Species of Bembex in the British Museum*. By ROWLAND E. TURNER, F.Z.S., F.E.S.

*Bembex obtusa*, sp. n.

♂. Niger; mandibulis, apice excepto, labro, clypeo, fronte macula obliqua nigra utrinque, scapo, orbitis externis, pronoto margine postico, callis humeralibus, prosterno, mesosterno antice, mesonoto linea supra tegulas, scutello linea obliqua utrinque, postscutello margine postico, pedibusque flavis; femoribus anticis supra nigro-lineatis, tarsis anticis infra nigro-maculatis; segmento dorsali primo macula transversa utrinque fasciaque transversa mediana angustissima, segmentis dorsalibus 2-6 fascia transversa bisinuata, ventralibus 2-5 macula utrinque, segmento ventrali primo fascia angusta apicali flavo-olivaceis; flagello subtus ochraceo; segmento dorsali sexto apice, septimoque dimidio basali ferrugineis; alis hyalinis, venis fuscis, thorace duplo longioribus.

Long. 21 mm.

♂. Clypeus very broadly triangularly flattened on the apical half, labrum flattened at the base; a strong longitudinal carina between the antennæ; sixth, seventh, and eighth joints of the flagellum each with two or three small spines beneath,